Apparatus Handbook

Goal

The goal of this handbook is to provide all new trainees and certified apparatus operators with an easy to use reference for finding all relevant and current information for operating and maintaining all Lincoln Fire and Rescue apparatus and the equipment carried on the apparatus.

The concept behind this document is to reorganize and verify all practices, procedures and policies for operating and maintaining apparatus and equipment. This document will establish current practice for prospective and current certified apparatus operators.

This handbook does not replace Management Policy, but a supplement to it. This handbook does identify all Management Policies that are relevant to apparatus operation and equipment. The handbook will be updated on an as needed basis.

If any personnel see an error, omission or have an addition they would like to see added, they should forward that request to the Deputy Chief of Training. All changes and additions will be handled through training division in coordination with the Deputy Chief of Maintenance.

Chapter Two
Driving Basics

Driving emergency response apparatus is an important duty. **It is the responsibility of the FAO to have the apparatus under complete control at all times.** This section of the handbook will identify important guidelines for a certified driver and students to adhere too while operating Lincoln Fire and Rescue apparatus. All guidelines contained in this section come from two sources; IFSTA manuals and the referenced Management Policies.

- It is important that all certified drivers and candidates remain calm and drive in a safe manner. Reckless driving, even in response to an emergency, is never acceptable.

- All LFR drivers should be cautious in obtaining the right of way while responding with lights and sirens. The operator should be prepared to yield the right of way in the interests of safety.

- All certified drivers and candidates should follow MP 859.60 when operating Apparatus. This is LFR's minimum guideline for safe operation of Fire and Rescue vehicles during emergency response.

- Most driving regulations pertain to dry, clear roads and most accidents happen on dry clear roads. All LFR certified drivers should adjust their speed to compensate for poor weather, road conditions, darkness or any other condition that makes normal emergency vehicle operation more hazardous. It takes 3 to 15 times more distance to stop on snow and ice than on dry pavement.

- All LFR certified drivers are required to stop for any school bus loading or unloading students and have the flashing signal on and stop sign deployed. Do not proceed until the school bus driver indicates it is safe by turning off the stop signals and retracting the stop sign. This procedure is to be followed whether responding code one or three.

- No LFR certified driver should proceed past an activated RR crossing signal or gate until the railroad crossing signal or railroad personnel indicate that it is safe to cross. Always double check up and down the track for additional trains approaching.

- Intersections are the most likely place for an accident involving emergency vehicles. Therefore LFR certified drivers should approach all intersections at a speed that allows a stop to be made at the intersection if necessary. The operator should be able to account for all lanes of traffic before proceeding through the intersection. Blind and heavily traveled intersections should be approached and crossed at a reduced speed of 15 to 20 mph.

- All LFR certified drivers should remember that sirens and other warning devices have an effective range. Warning lights may be less visible during poor weather conditions and warning sirens are affected by vehicle speed. According to IFSTA an emergency vehicle traveling at 40mph will project it's siren approximately 300 feet in front of the vehicle, while the same vehicle traveling a 60mph will only project approximately 12 feet in front of the vehicle. Always keep this in mind while operating on expressways, interstates and highways. Whenever weather conditions cause mud, snow, or road grime to accumulate on vehicle warning lights operators should clean them off periodically during their shift.

- Lincoln Fire and Rescue's Opticom system is set up to capture the light for an apparatus traveling at the posted speed limit. If an emergency response vehicle is traveling faster than the posted speed limit, the Opticom system will not operate efficiently to control the intersection traffic lights for the direction of the emergency response vehicle.

- If the apparatus operator needs to use the oncoming traffic lane. The operator should travel at a speed that allows sufficient time for oncoming traffic to see the fire apparatus and react or the fire apparatus can safely stop. Operators should avoid using the oncoming lane if oncoming traffic is unable to see your approach.

- Defensive driving tips.

  Aim high in steering
  Stay back and see it all
  Keep your eyes moving and scan traffic
  Always leave yourself an "out"

- When driving in traffic non-emergency always leave approximately one rigs length between your rig and the traffic you are following including when stopping at stop lights and stop signs.

Zone Books

The information contained in this section is geared for the new apparatus operator trainee.

All Lincoln Fire and Rescue response vehicles have up five types of Maps available to assist in response.

- Zone Book for the units primary response district
- All City Zone Book
- County Map Book
- Area Hospital Map Book (Medic Units only)
- Mobile Data Terminal

The zone book is a set of street maps of the city broken down into one square mile blocks or zones and assigned a number. This number enables a dispatch address to be narrowed down to a particular part of the city. An address will be given by dispatch in this form"Zone 122, 3640 Toulizan Ave" This way if the operator does not know where that address is, he or she can use the zone book to find the address, buy opening it to Zone 122 and then finding the street on the map. This greatly simplifies the process of finding an unknown address. The book also includes hydrant locations, sprinkler hook ups, standpipe hookups, apartment building layouts and entry codes for the apartments. Once the operator becomes familiar with the zones he or she will be able to recognize fairly quickly the area of the city where the dispatch address is located. Most stations will also have a wall sized map of their district divided into the zones in the station for reference as well.

Lincoln Fire and Rescue encourages all certified drivers in cooperation with their officer to keep the zone book up-to-date on a regular basis. All certified drivers and trainees should strive to learn their assigned response district through the study of the zone book and physically driving the streets. Lincoln Fire and Rescue encourages all floating certified drivers to familiarize yourself with the zone book and district of the unit your are assigned to that day.

Lincoln Fire and Rescue encourages all certified drivers to look up an unfamiliar addresses prior to leaving the station and be proficient in learning their district. Captains will assist en route with the zone book as necessary to assure a efficient and error free response.

Addressing Basics

This next section contains some basic explanation of how street addresses are constructed and laid out in the City of Lincoln.

In the older areas of Lincoln streets generally are laid out as follows. All numbered streets run North/South and lettered or named streets run East/West.

Examples for North and South are; 56th, 70th and 27th Streets.

Examples for East and West are; Vine Street, Pioneers Blvd., "A" Street and "F" Street.

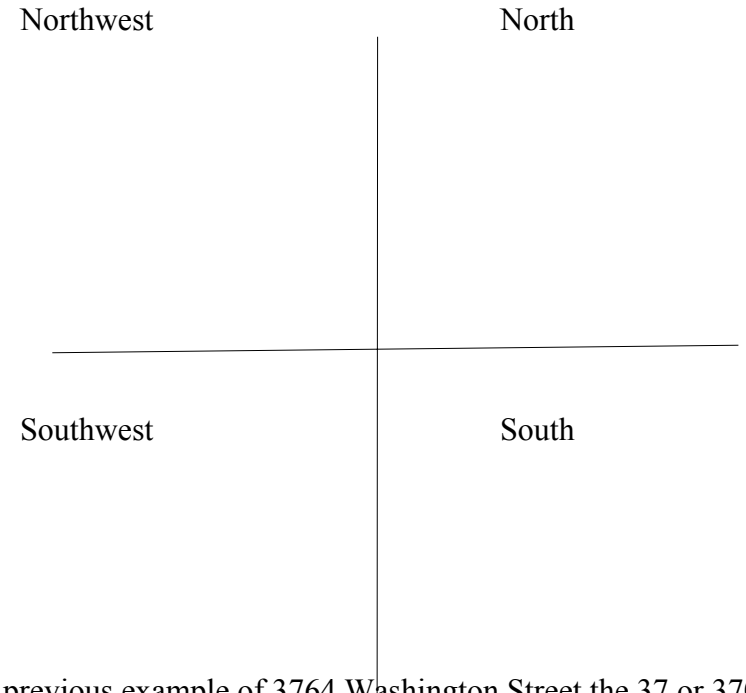
Although in new developments this will not be true as the streets are not laid out in a grid pattern.

All addresses are made up of several parts, mostly numbers. We will use 3764 Washington Street as an example. The 37 indicates the cross street and Washington indicates what street the house is on. From these two items you know that the house is on Washington Street after crossing 37th street and the street probably runs East/West. Now you can use the last two numbers 64 to determine what side of the street it is on. If the last two numbers are even, such as 10, 66, 32, 02 or in this case 64 it will be on the North side of the street. If the last two numbers

are odd, such as 01, 33, 77 you know the house would be on the South side of the street.

Always remember if the last two numbers of the address are even the building will be on the North or East side of the street and if the last two numbers are odd the building will be on the South or West side of the street.

Another important address component to understand is the hundred blocks. The City of Lincoln is divided into four basic quadrants with "O" street being the North/South dividing line and 1st Street being the East/West dividing line.



Using our previous example of 3764 Washington Street the 37 or 3700 hundred block indicates that the address is the 37th block east of 1st Street. In other works once you cross 37th street on Washington Street you need to be looking for the house. If you had an address such as 803 North 56th street the hundred block, in this case 800, would tell you that the address is eight blocks North of "O" Street on 56th Street. Be aware that some streets don't go through and you may change to the next hundred block number without passing a cross street. If your address was 501 Northwest 3rd Street you would then know that the address was five blocks North of "O" Street on 3rd Street which would be west of 1st Street. The NW designation in the address indicates what quadrant the address is in.

These four quadrants North, South, Northwest and Southwest also indicate to you the general area of the city the address is in, at least for numbered streets. Be aware though that a majority of the City is located in the North and South quadrants.

When the streets reach100 city blocks they will be expressed as five digit addresses. An example would be Novartis Consumer Health INC. at 10401 HWY 6. If you were responding on HWY 6 to this address once you pass the cross Street of 98th Street you would need to look for the address number of 10401. If there was a cross street in this area it would be 104th Street. Also the 01 would indicate the side of the road the building is on. In this case the South side.

All operators should know the following hundred block street designations. These are East/West running streets listed from North to South.

Fletcher Street	6000
Superior Street	4600
Havelock Street	4400
Adams Street	3000
Holdrege Street	1500
Vine Street	800
R Street	400
O Street	100
Randolph Street	800
South Street	2200
Van Dorn Street	2800
Pioneers Blvd.	4300
Old Cheney Road	5700
Pine Lake Road	7000
Yankee Hill Road	8400

For North/South running streets such as 48th street the hundred block designation for the East/West axis are the street numbers. So in this case if you are traveling east on "O" street when you cross 48th street, which runs North and South you have reach the 4800 on "O" street and when you reach 56th street you will be at the 5600 block.

When traveling East and West in the older areas of town this concept is very straight forward, but remember when working in the newer areas of town that have serpentine streets and named streets only the hundred block numbering still applies. The houses will be numbered based on the hundred block system following the same North/South or East/West concept. Be aware too that if you are traveling on a named street and it is originally traveling North/South then curves to the East/West axis the hundred block numbering will change to the new axis.

Apparatus Positioning

This section contains some apparatus positioning guidelines. Information contained in this section is a guideline only and does not replace direct orders or instructions of the Officer or Paramedic in charge of the apparatus or any unusual conditions found on arrival.

Staging Levels

Lincoln Fire and Rescue uses the following staging principle.

Level I Staging-Is put into practice during the initial response to a fire or medical incident involving more than one engine company. Level I staging is used on every response when two companies performing like functions are dispatched.(for example, two engines). The first due engine company, ladder truck, rescue or squad, and command officer proceed directly to the scene. Later-arriving units park or stage away from the scene in their direction of travel approximately one block away.

Level II-is used when numerous emergency vehicles will be responding to an incident. Incidents that require mutual aid or that result in multiple alarms. In this type of staging the incident commander will designate where units are to go, such as a parking lot. Apparatus drivers are to stay with their unit unless specifically given another assignment by their officer or the incident commander.

Fire Response Positioning

Engine Company Response Guidelines

- First in engine companies should stand-by the best hydrant available unless directed by the company officer or command to go to the structure.
- If possible, give the officer a three sided view of the structure by pulling slightly past the front of the building. This also allows the first in truck company access to the front of the building.
- The second in engine company should position at the rear of the structure, if possible.
- The third in engine company should position on the orders of the incident commander.
- Engines providing water for elevated master stream operations should position as close to the aerial as possible.
- When the structure is less than five stories high the engine can be positioned close to the building and the truck company outside the engine. If the building is over five stories high the truck company should take the inside position and the engine the outside postion.
- In Brush or grass fire situations it is best to operate from the burned side.
- When making hose lays minimize blocking other apparatus access to the fire building.
- When it is determined that a relay may be necessary coordination is essential for a successful relay. The first in engine may have to make the hydrant and lay out it's hose and continue in to the fire. The next in engine will then lay its hose from the attack pumper back to the first in pumper's hose and become the relay pumper. Apparatus should try to keep two sections of hose in reserve in case of hose failure. See Chapter 4 on pumps for more information on relay pumping.

Truck Company Response Guidelines

- When two aerials respond to a given location, the first-in aerial takes the front of the building and the second goes to the rear or side, depending on access. If level one staging is given the second aerial should stage one block away and await instructions from the incident commander.
- For fire rescue situations aerial should consider approaching from upwind and position at the corner of the structure to cover two sides of the building.
- When approaching from the downhill side, stop short of the fire building and operate the aerial over the front of the apparatus.
- When approaching from the downhill side, drive past the fire building and operate over the rear of the apparatus.

Medic Unit Response Guidelines

- When medic units are dispatched to a working incident the medic unit should report to command or staging.
- Medic units should position to facilitate transport of victims or injured fire fighters to a care facility. Medic unit drivers should ensure their vehicles do not block incoming fire apparatus, nor become blocked by hoses or apparatus.

All units should consider maintaining a collapse zone equal to one and one half times the height of the building if possible.

Limited Access Highway Operations and Car Fires

Engines and Trucks

- Place the fire apparatus between the flow of traffic and the incident. The apparatus should be parked at an angle so the pump panel and operator are protected from traffic by the tail board. The front wheels should be turned away from the incident. Additional engines or trucks should be placed 150 to 200 feet behind the first in apparatus.
- If a complete shut down of the highway is not possible, the lane next to the incident should be closed at minimum.

Medic Units

- If possible medic units should position away from the traffic flow to protect the patient loading area behind the unit. Ideally the medic unit would be positioned so that the fire apparatus acts as a shield for the patient loading area.
- Medic units should also consider their departure route to facilitate transport to the care

facility.
- Medic units should try to limit the need to back up with patients on board at the scene.

All Units

- Whenever responding to traffic accidents with any kind of commercial transport vehicle involved consider the possibility of a hazardous material release from the accident. You may have to stand off from the accident site uphill and upwind. In these situations communicate with the Company Officer for directions on approaching the incident.

Hazardous Materials Incidents
All Units

- Approach up hill and up wind if possible with a reasonable stand off distance.
- Stage on directions from Incident Command.

Trench Rescue Incidents
Engines, Trucks, and Medic Units

- Do not park closer than 100 feet to the incident.
- The exception is Utility 1 and the trench trailer, which can park 75 feet away from the incident.
- See Management Policy 850.05

Structural Collapse Incidents

- All vehicles stay back from the incident one and one-half times the height of the building.
- See Management Policy 850.06.

EMS Incidents
Engines and Trucks

- At all EMS responses the engines and trucks should leave the best placement position for the medic unit. Medic units need to have clear access to driveways and doors, this is for the benefit of the patient. We want to keep the patients exposure to the elements and public view to a minimum.

- Engine and Truck companies should place themselves to protect the Medic units from oncoming traffic. This is to provide a safer loading area for the patient and crews.

- See the Medic units section for more EMS positioning guidelines.

Chapter Three
Apparatus Maintenance Guidelines

This section contains the minimum information every apparatus operator should know and apply in the day-to-day operation of all Lincoln Fire and Rescue apparatus. The goal of this section is to provide a reference section for operators to find relevant information for maintaining apparatus. It will also serve as training tool for all new apparatus operators.

This document will be updated as necessary to keep it as current as possible. If operators have still have a question or concern after consulting this guide, then the Maintenance Shop or Training Division should be contacted for guidance. If anyone would like to add information, suggest a change, or finds a discrepancy please refer that information to the DC of Training.

This chapter will have several types of information. It will contain background information on some systems of the apparatus, such as air brakes, it will contain the fluid recommendations or where to find them, it will contain operating guidelines for the operator to use in maintaining the apparatus chassis and engine. The pump, aerial ladder and tools will be addressed in separate sections.

Wednesday and Daily Checks

All Lincoln Fire and Rescue apparatus have two types of checks or inspections performed; Wednesday and Daily. The basic difference between the two checks is the Wednesday check is the more in depth maintenance check and test day. During the Wednesday check all the apparatus systems and tools are checked and tested, where as on the Daily check only the main apparatus systems are checked, and the tools are not tested.

There is a form that needs to be filled out for each type of inspection. This form is the located on-line in the Intranet section of Lincoln Fire and Rescue web site. These two forms list all tests and inspections that the operator is required to perform and will be the operators guide for the inspection. This document will contain supplemental information to help operators complete these inspections so the apparatus are safe and that any possible mechanical problems will be identified early.

Whenever there is a question of what type of fluid should be used in a Lincoln Fire and Rescue fire engine or truck the operator should refer to the builders plate located on the lower part of the driver's door. This plate contains the mfg. recommended fluids that are used in that particular apparatus.

Engine and Transmission

Fan Belts

All Units: Check for looseness, look for any worn spots, fraying or cuts in the belt.

Batteries and Electrical System:

Engines and Trucks

To properly maintain batteries for Lincoln Fire and Rescue apparatus perform the following items.

- Keep the battery terminals clean. To do this the maintenance shop has authorized a spray terminal cleaner. Use this cleaner to maintain the terminals in good working order.

- The electrolyte level needs to be maintained according to the following standard. The electrolyte level should touch the bottom of the plastic guide located on the filler openings. At minimum the plates should be covered by electrolyte.

- Use distilled water to fill batteries. This is available from the current automotive supply house.

- Use the battery filler container to fill batteries.

- Verify that the alternator is charging the battery by starting the engine and checking voltmeter gauge. The gauge should be showing 13.2 Volts to 14.5 Volts.

Medic Units, A14 and Fire Cars

- Keep the battery terminals clean. To do this the maintenance shop has authorized a spray terminal cleaner. Use this cleaner to maintain the terminals in go working order.

- These batteries are sealed units and should not require any filling by the operator.

- Verify that the alternator is charging the battery by starting the engine and checking voltmeter. The gauge should be showing 13.2 Volts to 14.5 Volts. Any fluctuation of the gauge or an up and down change of the high idle notify the Shop.

Cooling System

Engines and Trucks

- The operator should check all hoses and clamps for tightness and leaks.

- To check coolant level on apparatus locate the sight glass that is positioned on the top, middle, and rear of the radiator. This sight glass should be full of coolant. If it is not, the operator should add coolant through overflow tank.

- The operator should also keep the overflow tank ½ full at all times.

- Coolant type: Use **Ready-to-use premixed Fleet Charge Antifreeze**. If you do not have access to this coolant for any reason, you may use a 50/50 mixture of coolant and distilled water. Distilled water is available from the current automotive supply house.

Medic Units, A14 and Fire Cars

- The operator should check all hoses and clamps for tightness and leaks.

- The operator should keep the overflow tank ½ full at all times.

- Coolant type: Use **Ready-to-use premixed Fleet Charge Antifreeze**. If you do not have access to this coolant for any reason, you may use a 50/50 mixture of coolant and distilled water.

Engine Oil

All Units:

- Check the engine oil with a warm engine that has been allowed to sit for approximately 5 minutes and parked on flat ground. Use the apparatus dip stick to measure the oil level. Oil should be added when the oil level has fallen to one half the distance to the add line.

- Fill the engine through the oil filler cap. **Do not overfill** the crankcase with oil.

- Recommended oil is **Rotella SAE 15W40 or Exxon XD-3 Extra 15W40.**

- When the apparatus is started the operator should check the oil pressure gauge. If the oil pressure does not start to rise within 5 to 10 seconds stop the engine and notify the maintenance shop.

- If the oil pressure gauge starts to flutter at anytime, that may be an indication of low oil level. If this happens contact the maintenance shop for guidance.

Transmission Fluid Level

Engines and Trucks

- To check the transmission fluid level have the vehicle on level ground with the

motor running. Check the fluid level through the transmission fluid dipstick. The fluid level should be kept at the full mark.

- **If the fluid level is found to be low the operator should report this to the Maintenance shop, who will be responsible for adding the proper amount of synthetic transmission fluid.**

Medic Units, A14 and Fire Cars

- Drive the vehicle until the engine reaches normal operating temperature (approximately 20 miles). Park on level ground. With the transmission in park and the engine running. Remove the dipstick, wipe it clean and reinsert, then remove the dip stick and inspect the level. The fluid should be in the area marked "H" or Hot on the dipstick. Do not drive the vehicle if the level is below the "C" or cold mark.

- **If the transmission fluid is low contact the shop for repair.**

- It is possible to check the fluid without driving if the ambient temperature is above 50 degrees Fahrenheit. However, if fluid is added at this time, an overfill condition could result when the vehicle reaches normal operating temperature.

All Units

- Operators should report any transmission fluid that has a brown coloring or burnt smell to the maintenance shop.

Power Steering Fluid

Engines

- Measure the fluid level with the dip stick provided on tank cap. Be sure the fluid level is between the add and full marks. Only add fluid if the level is at or below the add mark.

- If the fluid level is low fill with **15W40 Rotella Motor Oil or Exxon XD-3 Extra 15W40.**

Trucks

- The E-one truck companies power steering fluid is the same fluid that powers the aerial. Too check this fluid you need to access the aerial hydraulic fluid tank on the top of the apparatus under the aerial. T8 and T21 have a power steering reservoir located under the driver's side engine access hatch.

Medic Units, A14 and Fire Cars

- Check the fluid level when it is at ambient temperature, 20 degrees to 80 degrees Fahrenheit. Use the dipstick provided on the cap. Do not add fluid unless it is below the lower mark of the two on the dipstick.

- If the fluid level is low add regular **power steering fluid.**

Windshield Washer Fluid

All Units

- Generally the windows should be cleaned with window cleaner on a regular basis.

- Fill as necessary with windshield washer fluid.

Tire Pressure

Engines and Trucks

- All operators should use the Manufacturers recommended tire pressure listed on the Mfg. label located inside the driver's side door step area. This label is yellow or white and includes date of mfg and other information including the recommended tire pressure.

Medic Units

- Operators should use the tire pressures listed on the Wednesday Ambulance Inspection Report**. These pressures were established by the maintenance shop.**

All Units

Operators should check for the following problems:

- Tread or sidewall separation
- Audible leak (or flat)

- A cut exposing the ply or belt material
- Uneven tread wear
- A tread groove pattern depth of less than 4/32 of an inch on the front tires or 2/32 of an inch on the rear tires.
- **During the Wednesday check operators should check all wheels for loose lug nuts. You may have to remove chrome hub caps or lug caps to do this.**
- When checking the lug nuts on the front wheels of the fire apparatus the operator should also check the front wheel hub oiler. There is a sight glass located on the hub center. The fluid level should be between to full and add lines. Also check that the plug has not fallen out. If the plug is gone or the fluid is low or empty do not drive the vehicle and contact the shop.

Diesel Fuel Supplement

- Diesel fuel supplement should be added to LFR's diesel fueled vehicles when the outside air temperature reaches 5 degrees or below. This is to prevent gelling of the diesel fuel. The supplement also cleans the injectors and disperses any water in the fuel.

- 5 oz for 15 gallons of fuel
  10 oz for 30 gallons of fuel
  14 oz for 45 gallons of fuel
  19 oz for 60 gallons of fuel
  32 oz for 100 gallons of fuel

Braking System Types and System Checks

Engines and Trucks

Lincoln Fire and Rescue fire apparatus are equipped with air brake systems. Our apparatus are also equipped with anti-lock brakes and some units have a supplementary braking systems otherwise known as jake brakes, compression brakes, retarders. This section will layout a brief description of the systems and operational guidelines for maintaining and using the systems.

Air Brake Systems

Air brakes use compressed air to make the brakes work. This type of brake is a good and safe

way of stopping large and heavy vehicles, but the brakes must be well maintained and used properly.

Air brakes are really three different braking systems put together: service brake, parking brake, and emergency brake.

- The service brake system applies and releases the brake when you use the brake pedal during normal driving.

- The parking brake system applies and releases the parking brakes when you use the parking brake control.

- The emergency brake system uses parts of the service and parking brake systems to stop the vehicle in the event of a brake system failure.

There are many parts to an air brake system. This description only includes the major components. Each system is equipped with an air compressor that pumps air into the air storage tanks. The compressor is connected to the engine through gears or a belt. There is an governor that controls when the air compressor will pump air into the storage tanks. The governor usually cuts in the compressor when the storage tank pressure falls to 100psi and cuts out the compressor when the storage tank pressure reaches 125psi.

The storage tanks are used to hold compressed air for brake use. The number and size of storage tanks varies among vehicles. The tanks will hold enough air to allow the brakes to be used several times even if the compressor stops working.

The system will also have a device installed to dry the compressed air. Compressed air usually contains moisture. This is mostly to protect the brake system from freezing in cold weather causing brake failure.

The system will have a safety valve installed in the first tank the air compressor pumps into. This valve protects the system from to much pressure. The valve is usually set to open at 150psi. **If the safety valve activates, something is wrong. Have the unit vehicle checked by the Maintenance shop.**

In an air brake system you activate the brakes by pushing down the brake pedal. Pushing the pedal down harder applies more air pressure. Letting up on the pedal reduces air pressure and releases the brakes. Releasing the brakes lets some air out of the system, so the air pressure in the tanks is reduced. This will cause the air compressor to cut in and increase pressure in the tank. Pressing and releasing the pedal unnecessarily can let air out faster than the compressor can replace it. If the pressure gets too low, the brakes won't work. The air brake system is connected to some type of brake shoe attached to the wheels.

All air braked vehicles have a pressure gauge connected to the air tank. If the vehicle has a dual air brake system, there will be a gauge for each half of the system or a single gauge with

two needles. These gauges tell you how much air pressure is in the storage tank(s).

A low air pressure warning signal is required on vehicles with air brakes. A warning signal you can see must come on before the air pressure in the tank falls below 60psi. The warning is usually a red light, but may also have an audible warning as well.

All air brake equipped trucks must be equipped with emergency brakes and parking brakes. They must be held on by mechanical force (because air pressure an eventually leak away). Spring brakes are usually used to meet these needs. When driving powerful springs are held back by air pressure. If the air pressure is removed, the springs put on the brakes. A parking brake control in the cab allows the driver to let the air out of the spring brakes. This lets the springs put the brakes on. **A leak in the air brake system which causes all the air to be lost will also cause the springs to put on the brakes**.

Typically the spring brakes will come on when the air pressure drops to a range of 20 to 45psi. If the low air pressure waning light and buzzer come on, bring the vehicle to a safe stop right away, before complete loss of the brakes occurs.

Some systems may be damaged if you push the brake pedal down when the spring brakes are on. The brakes can be damaged by the combined forces of the springs and the air pressure. Although many brake systems are designed so this will not happen.

Most newer heavy-duty vehicles use dual air brake system for safety. A dual air brake system has two separate air brakes systems which use a single set of brake controls. Each system has its own air tanks, hoses, etc. One system typically operates the regular brakes on the rear axles and the other system operates the regular brakes on the front axle.

Before driving a vehicle with a dual air system, allow time for the air compressor to build up a minimum of 100psi in both systems. The low air warning light and buzzer should stop when the air pressure in both systems rises to a value set by the mfg. This value is usually greater than 60 psi. The warning light and buzzer should come on before the air pressure drops below 60 psi in either system. Again if this happens safely stop the vehicle and have the brakes serviced.

Anti-Lock Brake Systems

Most Lincoln Fire and Rescue apparatus are equipped with anti-lock brakes. Basically this an additional braking system that is integrated with the regular air brake system. Anti-lock brakes use sensors and control box to detect wheel lockup and skid. It then modulates the brakes on and off at a very fast rate to keep the wheels from locking up and skidding on slick road conditions or panic stops. This system helps to keep the vehicle traveling in a straight line and bring the vehicle to a quicker stop compared to vehicles that do not have this system.

To operate this system the operator only has to step on the brake with firm steady pressure

and the system will automatically activate the anti-lock braking system as needed by the situation. It is important for the operator to remember to keep his/her foot on the pedal until the vehicle comes to a stop or the need to stop disappears.

The system has a red warning light located on the dash board. In normal operation this light will come on for a few seconds after starting the vehicle. If the light does not shut off or comes on while driving stop the vehicle and notify the Maintenance shop.

Supplementary Braking Systems

There are several types of systems currently in use on our apparatus. The Jake Brake and Extarder. Both systems work on the principle of using engine compression to help slow the vehicle down. DOT regulations require the installation of some form of SBS on apparatus with a Gross Vehicle Weight of 36,000 pounds or greater. Our apparatus fall into this category.

Lincoln Fire and Rescue Management Policy 852.23 states that this system should be used on emergency responses and normal driving during normal dry weather conditions. If the roads are snow covered, snow packed, icy or wet, these systems must be turned off. This for the safety of all crew and public alike.

This system has a control switch located on the operators dash board. Most have two control switches, one is an on/off switch and one is high and low switch. When the system is activated the operator may choose the high and low settings.

Lincoln Fire and Rescue Operator Air Brake System Inspection Guidelines

- Each day the apparatus parking brake should be tested for proper operation. This process is listed on the Wednesday Apparatus Inspection Report.
- Monitor the ABS red warning light after starting the engine to be sure the light does not remain on after a few seconds.
- When ever starting the apparatus be sure that the air pressure gauge is showing that the air pressure is starting to build.
- If inclement weather with slick or wet road conditions, be sure the Supplementary Barking System (Jake Brake) is turned off if your apparatus is equipped with one.

NFPA 1901 Apparatus Standards for Braking Systems on Fire Apparatus

- New apparatus must come to a complete stop from 20 MPH in 35 feet on dry

pavement.

- Parking brakes need to hold the apparatus on a 20 percent slopped incline.
- Air brakes must build to a sufficient level to allow operation within 60 seconds of starting the engine. **If not notify the maintenance shop.**
- Air horns should not be allowed to operate when the air pressure is below 80 psi.
- The low air warning light and buzzer should activate at 60 psi.

All Units

- **Report any grinding or rubbing sound from the brakes to the shop immediately.**

Apparatus Lighting Checks

All Units

- The operator should check all emergency warning lights for proper operation. If a warning light is not operating correctly notify the Maintenance shop for repair. Operators are not to attempt to service these lighting systems.
- The operator should check all headlights, turn signals, vehicle flashers, marker lights for proper operation. If a burned out bulb is found the operator should replace the bulb. All newer apparatus will be equipped with LED light systems and will not be operator serviceable. The maintenance shop will maintain the LED fixtures.
- The operator should test all spot lights and scene lights for proper operation. If a problem is found report it to the maintenance shop.
- All interior lighting should be checked for proper operation. The operator may replace these bulbs as necessary.

Miscellaneous Items

All Units

- Check for any loose or missing bolts, nuts and screws on the apparatus. Both on the interior and exterior of the unit. Tighten and replace as necessary.

- Check and report any obvious body damage.
- Check the steering wheel for excessive motion. IFSTA recommends steering wheels free play should be equal to 10 degrees either direction.
- The interior of the apparatus should be generally keep clean from dust, mud and debris.
- All apparatus cellular phones should be fully charged at all times.
- All mobile data terminals should be kept clean using Windex wipes only. **No other cleaning solution should be used.** The FAO will be responsible to reboot the MDT every morning.
- The EMS form binder should be kept filled with a complete set of forms and a sufficient supply, so when in the field the unit will have what is needed, when its needed.

Normal Instrument Reading Ranges

Oil Pressure	40 to 80psi
Engine coolant (water)	180 degrees to 200 degrees
Voltage	13.2 volts to 14.5 volts
Transmission Oil Temperature	180 degrees to 200 degrees
Air Pressure	110 to 120 PSI

Lincoln Fire and Rescue Engine Operating Guidelines:

- When starting the apparatus watch all gauges for proper readings to develop.
- If the apparatus is to be left idling for extended periods of time especially with waning lights activated. Increase the hand throttle to 900 to 1100 rpms or utilize the fast idle switch if your apparatus is equipped with one. Newer apparatus will

do this automatically for the operator.

- On all non-emergency responses or apparatus movements try to let the engine idle and warm up for 3-5 minutes. On emergency responses give the apparatus as many seconds as possible to warm up. The reasons for doing this are to minimize high piston ring wear, reduce oil consumption, reduce valve deposits which results in increased fuel consumption and generally try to lengthen engine life.

Chapter Four
Pumps, Operations and Maintenance

This section contains information on maintaining and operating fire pumps used on Lincoln Fire and Rescue as well as a small amount of background information on centrifugal fire pumps. To get the maximum knowledge available on pumps and pump theory the operator should review IFSTA Pumping Apparatus 7th edition and see the Supplement to The Essentials section of the Training Division web site. These two sources of information are Lincoln Fire and Rescue's standard resources for pumping apparatus.

CENTRIFUGAL FIRE PUMPS

Lincoln Fire and Rescue uses two stage and single stage centrifugal fire pumps for its main apparatus pump to move water to the attack lines ultimately on to the fire.

Nearly all fire apparatus being constructed today utilize this type of pump. This type of pump is classified as a non-positive displacement pump since it does not pump a definite amount of water with each revolution. Rather, it imparts velocity to the water and converts it to pressure within the pump itself. Since the water is thrown outward from the center of the impeller by centrifugal force, the pump is called a "centrifugal pump."

The centrifugal pump is based on the principle that a rapidly revolving disk (impeller) tends to throw water introduced at its center toward the outer edge of the disk. The faster the disk is turned, the more velocity the water has. This water is collected and confined within a container(pump casing). This confining of the water is what gives the pump the ability to create pressure.

This type of pump contains two main parts the impeller and the casing. The impeller transmits energy in the form of velocity to the water. The casing collects the water and confines it to convert the velocity to pressure. Then directs the water to the discharge of the pump. The impeller rotates very rapidly usually between 2,000 and 4,000 rpm. Water is introduced from the intake of the pump into the eye of the impeller, which is considered the center of the pump. The water is then thrown outward by the vanes of the impeller. This water is then confined in its travel by the shrouds of the impeller. The impeller is mounted off-center in the casing. This creates a water passage that gradually increases in cross-section as it nears the discharge outlet of the pump. This section is called the volute. This increasing cross-sectional area reduces the velocity of water, thus enabling the pressure to build up proportionately.

There are three main factors that influence a centrifugal fire pump's discharge pressure: the amount of water being discharged , the speed at which the impeller is turning, and the pressure that the water has when it enters the pump.

If all factors remain constant, the greater the volume of water being flowed, the lower the discharge pressure will be.

The speed of the impeller is an important factor in determining the pressure to be developed. The greater the speed of the pump, the greater the pressure that will be developed. This increase is approximately equal to the square of the change in impeller speed. If you double the speed of the impeller it will result in the pressure increasing four times if all other factors remain the same.

In a centrifugal pump the incoming pressure of the water adds directly to the pressure being developed by the pump, incoming pressure changes will be reflected in the discharge pressure.

Finally, since the centrifugal pump depends on the velocity of the water to move water through the pump, it is unable to pump air, therefore it is not a self priming pump. It needs an external force to remove the air from the pump and move water into the pump.

SINGLE STAGE CENTRIFUGAL PUMP

This type of pump is constructed with a single large impeller that pumps the full capacity of the pump and is referred to as a single-stage centrifugal pump. Capacities of this type of pump can be up to 2,000gpm. The main advantages to single stage pumps are less weight, less moving parts, and simpler to operate.

TWO STAGE CENTRIFUGAL PUMP

The second type of pump configuration is the two-stage centrifugal pump. This pump has two impellers mounted within a single housing. The two impellers are usually mounted on a

single shaft driven by a single drive train. The two impellers are generally are the same size and capacity. What makes the two-stage pump different from the single-stage is the ability to use the two impellers either in SERIES (PRESSURE) mode for maximum pressure or PARALLEL (VOLUME) mode for maximum volume. Although this adds another component to the system; The Transfer valve. This component makes it possible to switch between pressure and volume modes on the pump.

When the two-stage pump is in volume, each of the two impellers takes water from the intake and delivers it to the discharge. Each of the impellers delivers its rated pressure while flowing 50 percent of the rated capacity. The total amount of water the pump can deliver is equal to the sum of each of the two stages. So if you have a two-stage pump rated at 1000 gpm at 150 psi each impeller is designed to deliver 500 gpm for a total of 1000 gpm at 150 psi.

When the two-stage pump is in pressure mode, water from the intake is directed into the eye of the first impeller. This stage increases the pressure and discharges the water to the eye of the second impeller. The second impeller increases the pressure into the pump discharge port. The pressure is higher than when the pump is in volume because the water has passed through 2 impellers with each adding to the pressure. Because only one impeller is delivering water to the pump discharge instead of two, as in the volume position, the total volume of water is limited to the amount that one impeller can supply.

Generally two-stage pumps have more working parts, are heavier than a single stage pump, but are considered more versatile because of the ability to pump more pressure or more water which ever is needed. Therefore they are also considered more difficult to operate.

PUMP PRESSURES

To regulate pressure on a centrifugal pump, a hand operated pump throttle is provided. Opening or closing the hand throttle increases or decreases the engine speed which in turn increases or decreases the speed of the pump, impellers. As the speed of the impellers increase, the centrifugal force increases, which increases the pressure.

If a centrifugal pump has been discharging water at a certain pump pressure and all the discharges are shut off, the pump pressure will rise in proportion to the engine speed, and the amount of water it has been discharging. The speed of the engine will increase because the flow of water through the pump impellers has been stopped, due to having. no place to go, the water is merely being whirled by the impeller.

As the flow into the impeller is stopped, the motor is relieved of the labor of imparting a velocity to it. As the labor is relieved, the engine"picks up" in speed, having only the frictional pressure of the water trapped in the impeller against the water trapped in the volute or turbine casing to overcome.

If a centrifugal pump has been discharging water at a certain pressure through two or more discharges and one of these discharges is shut-off, the pump pressure will rise in proportion to the percent of volume as a whole that the closed discharges had been discharging. The increase in pump pressure will result in an increase in the volume of water flowing through the open discharge. This increase in volume will result in an increase in the

nozzle pressure that may be undesirable and may cause accidents or damage.

Closing the nozzle has the same effect on the pump pressure as closing a discharge gate. When the nozzle or discharge gate is opened again, the engine pressure will return to its original pressures.

When a pump is discharging water through one or more discharges, and an additional discharge is opened, the pump pressure will decrease, due to the water being able to escape faster through the greater discharge area.

This would mean that the pump operator must be at their pump controls constantly, ready to operate the throttle to increase or decrease the pressure as the nozzles are opened or closed for any reason.

TRANSFER VALVE

To make the change over or transfer from pressure to volume, two-stage pumps need a device called a change over or transfer valve. On Lincoln Fire and Rescue we refer to this device as the transfer valve.

The changing of the pump from pressure to volume, or vice versa, is controlled by the transfer valve. The operation of this valve either allows the water to enter both stages at the same time, and is propelled from them to the discharge manifold, or it allows the water to enter only one stage, and pass through it to the other stage then out into the discharge manifold. When operating in series, the part of the intake manifold that allows the water to pass into the other stage of the pump is closed automatically by the pressure generated in the first stage of the pump, and flowing backward in this part of the manifold thus forcing a gravity type clapper valve shut against the incoming water.

In other words, by operating the transfer valve, the water coming from the first stage of the pump is directed either to the discharge manifold or, directed back into the impeller of the second stage.

Transfer valves may be activated either manually, electrically, by air pressure, by vacuum or hydraulically. The control for this valve is located on the pump panel and is labeled "Transfer". Many of the power activated valves will operate at pressures as high as 200 psi. **But these pressures can present extreme danger to personnel and equipment, so Lincoln Fire and Rescue requires that the transfer valve be operated at 75 psi or less.**

WHEN TO OPERATE IN PRESSURE AND VOLUME

In order for any operator to give the proper pressures at the correct engine speeds, they must determine the volume of water to be used and from this will be determined whether the pump will be operated in either pressure or volume position.

When operating any centrifugal pump set the transfer valve in volume for large volumes of water (over half the rated capacity of the pump) . Set the transfer valve in pressure for lesser amounts of water (less than half the rated capacity of the pump) .

The operator's goal is to determine the correct position for the transfer valve, by obtaining the desired pressure at the lowest engine speed possible. If the desired pressure cannot be obtained, or the operator believes that the engine is running too fast, or is laboring, (learned

through actual practice and by studying the sound of the engine) the position must be changed; that is from volume to pressure or from pressure to volume.
Sometimes there will be little or no difference in the readings of the pressure gauge or the tachometer after a change has been made because with a centrifugal pump there is not any positive division as to when to pump in volume or pressure position. If the engine speed increases and the pressure drops, change from volume back to pressure; but if the engine speed drops and the desired pressure can be retained, leave it in volume.

Lincoln Fire and Rescue Transfer Valve Guidelines

- All two stage pumps will be in the pressure mode as the standard position for day-to-day operations unless it is necessary to supply more than ½ the rated capacity of the pump.
- The transfer valve should only be operated at 75 psi or less.
- The operator should attempt to anticipate the requirements that will be placed on the pumper as the fire fighting operation progresses and have the pump in the proper position.
- If the transfer needs to be made after water is already flowing, then the change must be coordinated through command so as not to put attack crews in an unsafe position.

Relief Valves

Lincoln Fire and Rescue fire pumps are equipped with device called a relief valve. The purpose of this device is to relieve sudden pressure increases to protect the firefighter on the attack line and the pump. The main feature of a relief valve is its sensitivity to pressure change and its ability to relieve excess pressure within the pump discharge. The relief valve relieves this pressure by diverting some of the water from the discharge back to the intake side of the pump. It permits the pump to continue pumping water when the pressure rises above the set pressure. NFPA requires relief valves to activate within 3 to 10 seconds after the discharge pressure rises at least 30 psi. There is a full explanation of how these valves work internally in IFSTA Pumping Apparatus Seventh Edition.

Lincoln Fire and Rescue pumps are equipped with Waterous and Hale brand relief valves. The relief valve controls are located on the pump panel. They are clearly labeled relief valves. The controls consist of the following. All relief valves will have a control wheel or T-handle used to set the activation pressure, they will have two indicator lights labeled open (amber) and closed (green), finally they may have an on/off switch. Some of our relief valves will also have a strainer located on the control. This is an item that will need maintenance during the Wednesday check.

Relief Valve Operation

Before setting the relief valve, all lines must be in operation at their respective pressure settings and the throttle adjusted to maintain these settings. Then to set the relief valve the operator will turn the adjusting wheel or handle clockwise to a pressure slightly higher than the operating pressure. While you are adjusting the relief valve pressure setting the amber light will usually be lit indicating that the relief valve is open and relieving pressure. Once you attain a relief valve setting that is slightly higher than your operating pressure the green light will come on and the amber light should turn off. This indicates that the relief valve is closed and you are pumping the desired operating pressure. From here on out the only time the amber light should come on is when the valve is open to relieve excess pressure.

When adjusting the relief valve the operator should turn the control wheel or handle at a slow steady pace, because it takes some time for the pressure to stabilize as it changes. To increase the relief valve pressure setting turn the control handle clockwise, to reduce the setting turn counter-clockwise. Once the operator has achieved the desired operating pressure give the adjusting wheel or handle a ½ turn more to set the slightly higher pressure level.

Lincoln Fire and Rescue Relief Valve Operating Guidelines

- Most rigs have their relief valves set at 150 to 200 psi
- If the valve is equipped with an on/off switch. The switch is kept in the off position.
- When setting relief valve pressure turn the control wheel slowly to give the pressure time to stabilize.

Wednesday and Daily Checks for Relief Valves

Wednesday Check

- Back the control wheel or T-handle out all the way and operate the on/off switch approximately 10 times to exercise the spring. Do this with the pump in gear.
- With the pump in gear determine if the relief valve is operating correctly and that the pressure setting is between 150 psi and 200 psi.
- If the relief valve is equipped with a strainer located on the relief valve control follow the instructions below.

  To clean the strainer, remove the strainer by turning the knurled knob counter clockwise. Remove the strainer and use clean water to rinse off the strainer. Reinstall the strainer. Tighten by hand only. This is best done with the pump in gear.

Daily Check

- With the pump in gear determine if the relief valve is operating correctly and that the pressure setting is between 150 psi and 200 psi.

WEAR RINGS AND PACKING

There is no positive mechanical isolation of the discharge side of the pump from the intake side of the pump. The water moving through the impeller prevents any water from escaping back into the intake side of the pump. Because the pressure is much higher in the volute than in the eye of the impeller a close tolerance must maintained between the pump casing and the hub of the impeller. This opening is usually approximately .01 inch. If the opening gets much larger the pump effectiveness lessens.

As impurities like sediment and dirt pass through the pump, they cause wear in this opening. As the gap increases, greater amounts of water are allowed to pass back to the intake side of the pump. If this gap increases to much the pump would no be able to reach it's rated capacity.

To maintain this gap between the impeller hub and the casing, the pump is constructed with replaceable wear rings. These wear rings are usually a type of rope fibers impregnated with graphite or lead. The material is pushed into a stuffing box by a backing gland driven by a packing adjustment mechanism. Normally when properly adjusted a small amount of water leaks out around the packing and this acts as a cooling mechanism to prevent excessive heat buildup. The proper adjustment is set by the manufacturer. The usual rule of thumb is when the pump is under pressure, water should drip from the packing glands, but not run in a steady stream.

Newer fire apparatus may be equipped with mechanical seals instead of packing, this type of seal will not drip and will not require adjustment. It is important to know that mechanical seals should be protected from freezing. Freezing causes damage that will necessitate immediate repair.

These seals may have a grease zerk associated with the packing seal. The grease helps keep the seal in the proper tolerance and keeps the shaft properly lubricated. Some pump will have this grease zerk and some will not. **On Lincoln Fire apparatus the grease zerk can be located in several places and some rigs do not have one.**

Some rigs will have the grease port located on the driver's side pump panel, which is the easiest to find. Others you will find by tilting the cab and removing the front pump access panel and locating the port on the pump.

Because excessive heat in the pump can effect this packing material and the seal that it provides, it is very important not to overheat the pump while operating. If the pump is operated dry for any length of time, it damages the shaft that the impeller is rotating on. Therefore the operator needs to monitor the pump while operating it to be sure it does not run dry or overheat.

The operator can monitor the pump easily but placing a hand on the intake to the pump. If it is warm to the touch you need to start cooling the pump. This situation is likely to develop if you have the pump in gear but are not flowing any water at the time. In this situation the water in the pump just churns and starts to absorbs the heat of the pump.

- The first way to protect the pump is to disengage it if you are not going to pump water for extended periods of time.

- Most Lincoln Fire apparatus have a pump cooling valves or circulator valves. This control is located on the pump panel. This valve is connected to the discharge side of the pump and enables the water to be flowed back to the water tank. This way the on board water will help cool the water that came from the pump. This valve should be cracked open one turn or so in the winter and all the way open during the hotter summer months.

- The last way is to open an unused discharge partially to keep water moving through the pump.

Operational and Maintenance Guidelines for Pump Seals

- If your apparatus has a grease port, then grease this port during the Wednesday check.

- During the Wednesday check put the pump in gear and operate the pump. This helps lubricate the packing seals. This is necessary for all types of pump packing and wear rings.

- When operating the pump monitor the pump for overheating and open the pump cooling valve as necessary to protect the pump. If you are not going to be pumping water for extended time periods, take the pump out of gear.

MIDSHIP TRANSFER DRIVE

The are several different ways to mount and provide power to fire pumps. The one that is most important to LFR operators is the midship transfer drive. This is the configuration that all LFR pumps use.

This configuration has the pump mounted laterally across the frame behind the engine. The vehicles engine is used to power the pump. This is accomplished through the use of a split-shaft gear case (transfer case) mounted between the transmission and the rear axle. By shifting a gear and collar arrangement inside the gear box, power is diverted from the rear axle to the fire pump. The pump is then driven by gears or a drive chain. It is important to note with this system that you can only operate one system at a time. You can either use the engine to power the wheels or power the pump, but not both at the same time. Brush 11 is an exception to this rule. The operation of Brush 11 will be covered in a separate section of this handbook.

The gear ratio is set to match the engine capabilities so that the pump will deliver it's rated capacity. This ratio is usually 1 ½ to 2 ½ times faster than the engine. The maximum capacity of this system is only limited by the power of the engine and the size of the pump.

The normal arrangement for the control of the transfer case is to have a control switch

mounted in the cab. The shifting of the transfer case can be done through a mechanical linkage, electrical power, hydraulic control or an air-operated system.

To properly place the pump in gear the operator will stop, put the transmission in neutral and set the parking brake on the apparatus. Before leaving the cab the operator will operate the transfer case control. On LFR most rigs will have a three position control stick. The up position is the road position, middle is a neutral type position, and the down position is pump gear. The operator should move this control from the up position down to the pump position pausing slightly in the middle position. Once this is done the operator then puts the transmission selector in the drive position. If the apparatus is equipped with an electric transfer control you will only have a two position switch.

Most transfer controls will have an indicator light on the dash and on the pump panel. The light will be green if the pump is properly engaged. On most apparatus manufactured the operator can also determine whether the pump is engaged by looking at the speedometer. If it is registering 10-15mph the pump is engaged. Although this will not always be the case on new apparatus. The operator will have only the indicator lights for verification.

Another important point to remember is that when the operator places the transmission in the "D" position the transmission automatically selects the transmission gear setting for pumping. This gear position is usually position 4. This way the pump will turn at the required speed for pump operation.

Some apparatus are equipped with a manual override control. This control is for putting the pump in gear in case the powered transfer system fails. This control is not on all apparatus. If you have one, it may be located on the pump panel and clearly labeled or it may be located below the pump panel slightly under the body work.

PRIMING PUMP

The centrifugal fire pump is not able to pump air. It is a non-positive displacement pump and therefore requires an outside source to remove the air and fill the pump with water so it can operate or prime the pump. The centrifugal pump may use one of three types of priming pumps: positive displacement (rotary gear), exhaust primers, and vacuum primers.

Lincoln Fire and Rescue pumps use rotary gear primers. The control for this primer is located on the pump panel and labeled Primer. To activate the primer pull the control handle and hold as long as you need the primer pump activated.

Primer Pump Operation Guidelines

- Engine speed should be between 1,000 to 1,200 rpms.
- Operate the primer control for 10-15 seconds or a maximum of 30 seconds. If no prime is achieved stop and find the problem. The most common problem is an air leak.

Primer Pump Wednesday Check Guidelines

- During the Wednesday check the operator needs to be sure the primer tank is full. If

it is low add 30 weight motor oil or the fluid specified on the builders plate inside the Driver's door.

- The primer control should be operated during the Wednesday check. This activity keeps the primer parts lubricated to assure proper operation.
-

PRESSURE GAUGE

Fire pumps have pressure gauges mounted on the pump panel to record the incoming water pressure and the out going water pressure. The pressure gauge is connected to the discharge manifold and registers the pressure of the water within the pump. This pressure gauge may be a compound type, or it may be a straight pressure gauge. On most pumps, individual pressure gauges are also installed on each discharge gate on the discharge side of the valve. This eliminates guess work when two or more lines are operated from the same pump.

Miscellaneous Controls and Procedures

Engine Cooler

This control is used when the apparatus's engine is overheating. If the engine temperature starts to rise to around 200 degrees Fahrenheit the operator should open the pump cooler control.

Radiator Fill Valve

Some apparatus may have a control labeled Radiator Fill. This control is for adding water to the engine cooling system if it should be running low. **Since this control fills the radiator with water from the pump it should only be used in a emergency**. There are no operator maintenance procedures for this control.

Tank Fill Control

- This control primary function is to fill the onboard water tank from a hydrant hook up.
- The secondary function for this control is to circulate water from the pump back to the tank and vise-versa. LFR partially opens this control during the winter months when the outside air temperature approaches freezing to keep the water in the pump from freezing. This action is coupled with putting the pump in gear.

Tank to Pump Control

- This control is used to turn the water flow from the water tank to the pump on and off.

Foam Eductor Controls

- Most of Lincoln Fire and Rescue pumpers have an apparatus mounted foam educting system.
- The controls and instructions for activating the system are located on the pump panel.
- Some rigs will have both Class A and B, but some will only have one or the other. **If the operator is not normally assigned to these rigs, they need to know which**

foam is in the on board tank. Usually it is Class B foam.

- All LFR apparatus carry several extra buckets of Class A and Class B foams. These extra buckets are either carried in compartments or up top next to the booster reel and deck gun.

Wednesday Check

- **All foam containers should be turned upside down or right side up depending on the position they are in. This is to keep the foam concentrate mixed throughly.**

- All pump control handles should be operated during the Wednesday check and wiped down with a clean rag and silicone lubricate applied.

- All pump drains should be opened and all the water drained out and closed. This helps keep the seals in proper working order.

Pump Heater Control

All apparatus have a pump heater which is used mostly in the winter to help keep the pump from freezing up. The switch to control this heater is not usually labeled nor in plain sight. A few apparatus may have the switch mounted on the pump panel, but most apparatus will have the switch mounted in the pump compartment. Open the pump panel access doors and look for a simple unlabeled on/off switch. This switch should be turned on in late fall and off in late spring.

Lincoln Basic Pump Operation Guidelines

Engaging Pump

1. Bring the apparatus to a full stop and allow the engine to idle down.

2. Shift the transmission into neutral and set the parking brakes

3. Operate the pump shift control. This control is on the drivers side of the cab on the dash board.

4. Shift the transmission into the drive position. On most rigs this is 5^{th} gear or "D", but the transmission automatically puts the transmission into 4^{th} gear.

5. The apparatus may have a green indicator light on the dash or pump control. This light will be lit if the pump is properly engaged. On some apparatus you also can look at the speedometer, if the pump is properly engaged the speedometer will register 10-15mph. All apparatus will have a green indicator light on the pump panel and this light will be on if the pump is engaged.

6. If the light is not on or when you throttle up the compound gauge does not rise the pump is not engaged. Throttle down and retry the above process. If the pump still

does not engage notify your Officer immediately.

7. To disengage the pump reverse the procedure. **Always throttle down to idle before engaging or disengaging the pump.**

Procedure for transition from tank water supply to a hydrant water supply

1. Engage the pump.

2. On LFR all pumpers normally have the tank-to-pump valve open, which allows water from the tank to flow into the pump.

3. Hook up the hydrant line to the intake steamer connection. LFR uses the 5 inch (LDH) supply line as the standard hydrant supply line.

4. The intake bleeder control should be open. The gate valve control wheel should be opened slightly before the hydrant is opened. This action makes it easier to open the gate valve.

5. Notify the person at the hydrant to open the hydrant via radio or hand signal.

6. While opening the gate valve simultaneously close the tank-to-pump control.

7. Once the gate valve is open and the tank-to-pump control is closed and all the air is bled out of the water stream. Close the bleeder valve.

8. Proceed to slowly open the discharge valves for water flow.

Drafting Water from a Static Source

Lincoln Fire and Rescue vary rarely is called upon to draft water from lakes, ponds or other man made sources. LFR does provided fire protection to one business outside of Lincoln, which would require drafting water in the event of a fire. This business has a pond water source equipped with a dry hydrant and two sections of hard suction. Lincoln Fire and Rescue does not have it's own hard suction or strainers.

Lincoln Fire and Rescue does require operators to know how to draft water and these are the guidelines that should be followed in the event the operator is called upon to draft.

Guidelines

- When pumpers draft water the pumper's intake compound gauge will register vacuum readings instead of pressure. This vacuum is measured in inches of mercury expressed as mm/hg. Most fire pumps develop 22 inches of mercury (560mm/hg). This figure represents the maximum amount of vacuum the pump can develop. A reading close to this figure means the pump is at capacity.

- In an emergency you can use any type of water for drafting although water with a lot of debris may cause the intake strainer to become blocked. The pump will have to be flushed out after using dirty water.

- NFPA and Underwriter's Laboratories require that a pump be rated to pump their capacity at 10 feet of lift. Lift is the distance from the eye of the pump to the surface of the water. The maximum lift for fire department pumpers is considered to be 20 feet. At 20 feet the pump can deliver only about 60 percent of the rated capacity.

- When connecting hard suction to the apparatus check the suction hose gaskets for damage and use a rubber mallet to tighten the connections. Make the connections directly inline with the pump intake. Air leaks are the most common cause of drafting operation failures.

- While the pump is operating, a gradual increase in the vacuum reading may be noted with no change in the flow rate. This is an indication that a blockage is developing.

- If the pressure gauge starts to fluctuate and shows a gradual decrease of the discharge pressure. The operator should decrease the engine rpm until the pressure drops. A drop in pressure indicates that the flow has decrease below the point of cavitation. Then look for the blockage.

Drafting Operation

1. Put the pump in gear.

2. If the pump is a two stage pump the pump should be in volume position during priming.

3. Make sure all drains and valves are closed and that all unused intake and discharge openings are capped tightly. Make sure the pump cooling circulator valve is closed for the priming operation, as it can be the source of an air leak.

4. Advance the throttle to approximately 1,000 rpms.
5. Operate the primer control handle. As the primer control is operated watch for a steady stream of water with no to air discharge onto the ground under the apparatus. The primer operation usually takes 10-15 seconds, if the pump is not primed by 30 seconds, stop the priming operation and check to find out what your problem is. The most common cause of inability to prime is an air leak.

6. After a steady stream of water is obtained, then advance the throttle and increase the pressure to between 50 and 100 psi before opening any discharge.

7. Now open the discharge slowly while observing the discharge gauge. If the pressure drops below 50 psi pause and allow the pressure to stabilize before opening the discharge further. **If you open the discharge to quickly the pump may lose it's prime.** If the pressure continues to drop operate the primer control momentarily to try and remove any trapped air.

8. If the attack line is not ready for water yet open an unused discharge and flow water out to keep your prime. The pump requires constant movement of water flow to keep the pump from over heating. If possible flow the excess water back to the source.

9. To shut down the operation, slowly decrease the throttle to idle, close the discharges and take the pump out of gear.

Sprinkler and Standpipe Operations

- Lincoln Fire and Rescue uses a standard pump pressure of 150 psi to support either a sprinkler system or standpipe system.
- General rule of thumb for sprinklers is that one 1,000 GPM rated pumper should supply the fire department connection for every 50 sprinklers that are estimated to be flowing.
- If the pump is a two stage pump it should be in volume to supply the sprinkler connection and pressure to supply stand pipe connections.
- Operators should not exceed 200 psi on any sprinkler or standpipe system unless it is known that it can stand higher pressures.

Relay Operations

Lincoln Fire and Rescue engine companies have been called upon to form relay operations from time to time. The guidelines established in this handbook are an attempt to standardize the operation and remove some of the confusion that can develop on the fire ground. This operation requires clear communication and good organization by the responding companies to be successful.

- Lincoln Fire and Rescue uses LDH as the supply line between units. This hose is considered to have no friction loss.
- IFSTA recommends that apparatus keep two sections of hose in reserve for possible hose breaks. Therefore operators should attempt to lay approximately 500 feet of LDH between pumpers. This way LFR can establishe a standard distance between pumpers and have back up hose evenly spaced through out the operation.
- Once the need for a relay is determined units will have to coordinate their actions. The operation will need one pumper at the source, one attack pumper and as many relay pumpers as necessary to cover the required distance.
- An Officer should be put in charge of the relay operation and assigned a separate radio tach channel.
- Lincoln Fire and Rescue uses the constant pressure relay method outlined below.

Constant Pressure Relay

1. Position the attack pumper at the fire.
2. Position the largest capacity pumper at the water source.
3. Relay pumpers lay out their LDH at approximately 500' intervals.
4. Connect all lines.
5. All pumpers except the source pumper open an unused discharge. If the wait for water is more than a few minutes the relay pumper should wait with the pump out of

gear.

6. Starting with the source pumper pump 150 psi.

7. The operator of the first relay pumper closes the unused discharge simultaneously opening the discharge valve, once a steady stream of water flows from it, then advances the throttle until it develops 150 psi. Each relay pumper operator does the same. Once the relay is successfully established the source and relay pumper set the relief valves to 150 psi.

8. The attack pumper adjusts his discharge pressure as needed to supply the attack lines. The attack pumper will set the relief valve to the pressure needed for fire attack lines.

9. Operators should maintain flow through temporary shutdowns by using one or more discharge gates as dump lines.

Operators should keep correcting their pump discharge pressure to 150 psi until intake pressure from the hydrant drops to 20 psi. If the intake pressure falls below this amount, there is a danger the pump will go into cavitation. This can be recognized by the fact that increasing engine rpm does not result in an increase in discharge pressure. This is a signal that the relay's maximum capacity has been reached.

Operators of the relay pumpers should maintain a residual intake pressure of 20 to 30 psi. If the relay pumpers residual is greater than 50 psi the dump line should be gated down until 20 to 30 psi is achieved otherwise the pump could go into cavitation.

When the next pumper is ready for water the relay operator should coordinate the opening of the discharge line with the closing of the dump line to keep the residual pressure under 50psi.

As long as the intake pressure does not drop below 10 psi or increase above 100 psi, no action is required by the operator.

Relay operations should be shut down from the fire scene first.

Aerial Master Steam Support

Lincoln Fire and Rescue pumpers may be called upon to pump to aerial master streams. Operators should follow the guidelines listed below unless the incident commander gives different instructions.

1. Establish hydrant water supply and lay in LDH hose to aerial.

2. The pumper should be positioned as close as possible to the aerial.

3. Make the following LDH connections.
   First, connect hydrant supply line to the engine's pump intake.
   Second, connect LDH line to the engine's 3 inch discharge on the Officer's side of the pump panel.
   Third, connect the other end of the 3 inch discharge line to the aerial intake.

Currently T1, T5 and T7 have two intake points. One is the pump intake located on the pump panel. The other is a rear intake. The rear intake bypasses the truck's pump, so the crews have to communicate on which intake to use.

4. If the pumper is a two stage pump put the pump in volume mode.

5. Use the aerial ladder pump chart to establish pump pressure and do not forget to calculate the additional 5psi per floor for aerial height.

6. After getting the order to flow water. Slowly advance the throttle to the required pump pressure.

Chapter Five
Aerial Ladder Maintenance and Operation

This chapter covers the maintenance procedures that Lincoln Fire and Rescue apparatus operators are required to perform on our aerial, as well as general operating guidelines to be used in emergency response. Any firefighter seeking aerial certification should use IFSTA Aerial Apparatus First Edition as a reference and study guide. Specifically see Appendix E for E-one aerial apparatus information and Appendix I for Smeal aerial apparatus.

Currently LFR uses only rear mounted aerials with no platforms.

T1, T5 and T7 are 75 foot E-one aerials
T8 and T21 (reserve unit) are 105 foot Smeal aerials

Aerial Apparatus Positioning Guidelines

The guidelines contained in this section are intended to help LFR establish a standard practice for responding to incidents, these guidelines are to be used unless the incident commander or officer in charge of the truck companies give different instructions. These guidelines are taken from the IFSTA Aerial Apparatus First Edition.

- When two aerials respond to a given location, the first-in aerial takes the front of the building and the second goes to the rear or side, depending on access. If level one staging is given the second aerial should stage one block away and await instructions from the incident commander.
- For fire rescue situations aerial should consider approaching from upwind and position at the corner of the structure to cover two sides of the building.
- When approaching from the downhill side, stop short of the fire building and operate the aerial over the front of the apparatus.
- When approaching from the downhill side, drive past the fire building and operate over the rear of the apparatus.
- When the structure is less than five stories high the engine can be positioned close to the building and the truck company outside the engine. If the building is over five stories high the truck company should take the inside position and the engine the outside position.

Rescue-First Priority

- If possible aerials used for rescue should be positioned at the corner of a building to cover two sides.

- Victim priority is as follows:
  1. Most severely threatened by current fire conditions.
     Typically those victims located on or immediately above the fire floor.
     Panicked victims who appear ready to jump.
  2. Largest number or groups of people
     Two or more groups in the same amount of danger, go to the larger group first.
  3. Remainder of people in the fire area.
     Remove in descending order of numbers of victims.
  4. People in exposed area.
     Finally those who are in the least amount of danger.

- When raising an aerial to a victim the aerial should be positioned slightly above the victims position and lowered down to them. This is done to discourage victims from jumping on to the aerial.

- Lincoln Fire and Rescue aerials are designed to be used in the unsupported position, which means the tip should be positioned approximately 6 inches above window sill or roof, not directly on the sill or roor. This is especially important when the aerial device is operated at less than perpendicular angles.

- When making a rescue from a window place the aerial tip just inside the windowsill, with the first rung even with the sill.

- When making a rescue from a roof, balcony with railings or roofs with parapets place the tip of the aerial so that a minimum of 3 feet of aerial ladder extends above the roof line or railing.

Exposure Protection-Second Priority

- Position the apparatus for maximum coverage of the exposure.

- Generally use wide sweeping nozzle patterns.
  A fog stream will allow for maximum coverage of the exposure, but switch to a straight tip if high wind conditions or extensive heat from the fire is evaporating the stream prior to reaching the intended target. Straight streams must be constantly maneuvered to cover the entire face of the exposure.

- Do not direct water into man-made or natural ventilation openings.

Ventilation-third priority

- When placing the aerial for roof operations the tip should be extended 6 feet over the edge. Place the aerial as close as possible to the work area.

- The roof should also be laddered from a different side with ground ladders or another aerial to provide secondary escape route for crews on the roof.

- If a firefighter is on the aerial to break windows, position the aerial slightly above the window approximately five feet out from the building.

Elevated Master Streams for Fire Attack-fourth priority

Lincoln Fire and Rescue aerials are equipped with pre-piped waterways and pumps. The aerials are able to supply their own water for master stream operation or receive a water supply from pumpers. The rear 5 inch intake on the aerial apparatus are to be used when a pumper is supplying water. This intake bypasses the aerial's pump and therefore does not require a operator to man the aerial pump panel. If the aerial is supplying it's own water use the pump side 5-inch intake on the pump. This will require a pump operator and an aerial operator to be positioned on the aerial apparatus.

Another important note about Lincoln Fire and Rescue aerials is the master stream nozzle position on the fly section. The E-one aerials master stream nozzle travels with the top fly section, therefore when placing the aerial for rescue or roof operations operators must be sure the Nozzle and ladder pipe do not contact the window sill or roof. On the Smeal aerials the ladder pipe and nozzle have the capability to be pinned to the next lowest fly section to allow the top fly section to extend without the nozzle. The aerial is normally operated with the nozzle traveling with the top fly section. To keep the nozzle from extending with the top fly section the operator must engage the pin mechanism manually by climbing to the tip before extending the aerial.

- Never place more than two firefighters at the tip when using the master stream.

- Avoid moving the aerial when flowing water.

- Never direct water flow toward electrical wring from close range.

- Use the 75-80-85 rule of thumb for quick ladder pipe use.
  75 degree elevation
  80 percent extended length
  85 psi for a 11/2" tip

- Offensive attack.

Position the nozzle about even with the bottom of the window. This allows the water to contact the ceiling from about a 30 degree angle. Remember that water adds about 1 ton of weight per minute for every 250 gpms. When used for offensive attack, the stream should only be flowed long enough to blacked the fire down.

- Defensive operation

  Use a solid stream for deep penetration into the seat of the fire.

  If possible position the apparatus on the unburned side of the building.

General Aerial Operational Guidelines

- **Always check for power lines and other obstructions before raising the aerial.**
- Do not operate the aerial ladder in winds exceeding 35mph.
- When putting the outriggers down always use the steel foot plates for support. If outriggers have to be extended on soft ground additional cribbing may be necessary. Always be very careful to evaluate the potential for the outrigger to sink in soft ground including asphalt surfaces and concrete not designed to support vehicle traffic.
- When operating on uneven ground lower the high side jacks first and level the apparatus with the low side jacks until the interlock lights up.

  Do not exceed 5 to 6 percent grade side-to-side(lateral grade) or 12 percent grade front-to-back(longitudinal grade).
- Generally when operating on grades try to operate off the rear of the apparatus.
- The aerial should not be extended or retracted over the side of the apparatus.
- The E-one aerials are equipped with a platform under the pump panel. This is electrocution protection for the pump operator and should be used anytime the aerial is put up around electrical lines.
- Keep the aerial a minimum of 10 feet away from any power lines.
- When bedding the E-one aerials you must apply 1200 pounds of down force slowly to make the road travel ladder locks engage.
- Only engage and disengage the PTO with the engine at idle.
- When ever raising the aerial, chock the rear wheels of the apparatus. Note: Pull chocks out from under the wheels slightly prior to raising the jacks after aerial operation. This is to keep the chocks from becoming pinned under the wheels.

Aerial Maintenance

Lincoln Fire and Rescue operators should follow the guideline below to maintain their assigned aerial apparatus. The operator inspection of the aerial device is done during the Wednesday check. Listed below are some guidelines to assist the operator in making a thorough inspection.

- Check the aerial device and stabilizer jacks for visible cracks or broken welds.
- Check for any loose or missing bolts.
- Check the cables for broken strands or deformity
- Check the sheaves for bent flanges or worn sleeves.
- Check all hydraulic hoses and connections for leaks.
- Check the hydraulic oil tank for proper level. Both the E-one units and Smeal units tanks are located on top of the apparatus under the aerial device. The cap to the tank contains a dip stick. Use this dip stick to check the level. **If the level is half way between the fill and add marks notify the shop. The maintenance shop is responsible for filling this tank.**
- Set up and operate the aerial. Make sure all functions are operational.
- Check the heat indicators for change in appearance. There are multiple heat indicators located on each fly section. If they are colored black or are missing notify the shop. This should also be done after the ladder was operated near any fire.

Lincoln Fire and Rescue Aerial Apparatus Details

- All units have water pumps and 300 gallon water tanks. Except T-21 whose water tank is no longer in service. When doing the pump check on T-21 there is a garden hose attachment, which is used to supply water to the pump.
- Refer to MP 852.17 Aerial Set up and Stabilization.
- All LFR aerials are equipped with generators to supply electrical power. These units need to have their oil and coolant levels checked on Wednesdays. As well as the generator started and checked for proper operation.

Aerial Apparatus Special Equipment

Lincoln Fire and Rescue Truck Companies carry a number of specialized tools and equipment that need regular maintenance. The information you will need to perform this maintenance is contained on line either in the Supplement to the Essentials Manual section of the Interlinc web site or in Management Policy.

To find the Supplements to the Essentials follow the directions below.

Go to the Lincoln Fire and Rescue Interlinc web site.

Click on branches, then support services, then training, then Supplements to the

Essentials Manual.

The following tools and equipment are contained in this area.

Sawsall, Super Vac vent fan, Air hammer, Bullard, cutting torch, Echo chainsaw, K-12 saw and the Holmatro rescue tools.

Management Policy contains:

Rescue rope MP's 504.03 and 504.04
Passport Detector MP 504.12

Apparatus Equipment Testing and Maintenance

All other equipment carried on Lincoln Fire and Rescue that has specific procedures established for them will be contained in Management Policy and a list of these policies are a part of this handbook. The Fire Apparatus Operator will be expected to know these items, if it pertains to your apparatus. Although if you are a floating apparatus operator you will have to be familiar with all of them because you are likely to float into a apparatus that carries this equipment.

Chapter Six
Medic Units

Medic units present a special set of circumstances for LFR personnel. The operator is often assigned to the apparatus with a limited amount of training time. Most of the time the operator gets no direct instruction for how to properly do the job. Ths section has been created to establish a set of guidelines for operating and maintaining LFR's medic units. The ultimate goal being an efficient operation that benefits the crews members and the patient. Remember the ambulance transport side of our duties is a very customer oriented business and requires a lot of customer service procedures to produce a high quality product.

Medic Unit Positioning Guidelines:

- When medic units are dispatched to a working incidents the medic unit should report to command or staging.
- Medic units should position to facilitate transport of victims or injured fire fighters to a care facility. Medic unit drivers should ensure their vehicles do not block incoming fire apparatus, nor become blocked by hoses or apparatus.

- When ever Medic units are dispatched to a working incident with their stations fire apparatus, the Medic unit should let the fire apparatus leave the station first. Station 7 and Medic 7 would be an exception to this rule because of how the apparatus are normally positioned in the bay.

- If possible medic units should position away from the traffic flow to protect the patient loading area behind the unit. Ideally the medic unit would be positioned in front of the responding fire apparatus to act as a shield.

- Medic units should also consider their departure route to facilitate transport to the care facility.

- Medic units should try to limit the need to back up with patients on board at the scene.

- If medic units are dispatched to an MCI and sent to staging the operator should stay with the medic unit in case it has to be moved.

- When responding to an EMS call the operator should always to try to seek the safest area for patient loading. The safest areas are driveways and off street parking areas. If it is necessary to park on the street use fire apparatus already on scene to protect your patient loading area and from oncoming traffic.

- When responding to Medical calls LFR engines and trucks are to leave the area in front of the residence and driveway free for the Medic units.

Operating with Patients and Crew Onboard

- Overall operators should strive for smooth vehicle operation with crews and patients onboard.

- Operators need to be aware that hard cornering, quick stops, bumps and dips can cause a very rough and uncomfortable ride for patients and make it very difficult for paramedics to provide proper care especially when starting IV's and intubating en route. **Operators need to balance speed with smoothness.**

- Operators need to be aware that if crews need to defibrilate the patient, the Medic unit must be brought a safe stop for the procedure to be done.

- If a sudden stop has to done to avoid an accident. Communicate to the crew, if possible, before applying the brakes to allow them time to brace themselves.

- Generally all trauma patients will go to Bryan/LGH West, All burn patients will go to St Elizabeth, Cardiac patients could go the St E's or Bryan/LGH East. **Operators need to confirm hospital destination with the paramedic prior to scene departure. Operators are also required to be aware of hospital status changes.**

- When ever operators are waiting at the hospital while the Paramedic is doing his or her report they need to be aware of any incoming Medic units. If all the bays or bay slots are filled and a medic unit is coming in move your unit out to make room. This is especially important if the incoming unit has a critical patient on board.

Hospitals
St. Elizabeth

- Approach from the North off of "L" Street. Currently the ER entrance is located on the west side of the building. The ambulance bay has a door on each side and is a drive through bay. As you approach the door it will open automatically. If there are no ambulances in the bay pull to the right side of the bay. Leave the inside position free for a second unit.

- The linens for the cots are located straight back from ambulance entrance glass doors next to ER room #2.

- The mop bucket is located just inside the ambulance entrance glass doors.

Bryan/LGH East

- The ER entrance is located on the South side of the building off of Sumner street. You can approach from either the east or the west on Sumner Street. You will have to back into the unloading area.

- The linen cart is located in the ER close the nurses station of the east side.

- The mop bucket is located in a closet across from the LFR reporting computer.

Bryan/LGH West

- The ER entrance is located on the West side of the building. You can gain access off of South street and Lake street from either the East or West. The ambulance bay is a covered bay that will allow approximately four to six ambulances. All Medic units are equipped with a door opener to open the door. If the bay is empty pull to the most forward position on the right side of the bay.

- This ambulance bay is equipped with a garden hose and mop bucket for clean up.

- The linen cart is located just inside the sliding glass doors.

- Medic Unit operators are also tasked with filling out the proper billing forms and obtaining the proper signatures needed from the patient or family.

Periodic Upkeep of Patient Compartment

- Be sure there are no visible blood or body fluid stains on the floor, side walls, seats, grab handles, counter tops and the inside and outside door handles. Clean and disinfect immediately. This should be done in the morning when coming on duty and after every call.

- Sweep out any gravel, glass shards or debris in the patient compartment as necessary to keep the patient compartment clean.

- The patient compartment floors, side walls, seats, counter tops, and grab handles should be totally scrubbed, disinfected and cleaned at least once a working set.

- The cot floor brackets should be removed and cleaned underneath once a set and the

bolt threads should be lubricated carefully to be sure they do not become frozen in place from water rusting the threads.

- After every call the operator is responsible for cleaning up the Medic unit and putting equipment away.
- The operator should also keep a list of supplies that need to be resupplied after returning to the station.
- Once a set the floor grate located on the side door compartment entrance needs to be removed and cleaned of debris and any wetness dried out. The grate should be scrubbed with soap and a brush, dried and replaced.
- Any loose interior panels screws and bench seat hinge screws should be tightened.

Cot Operation and Maintenance

- The cot needs to be cleaned on regular basis. After every call it needs to be disinfected and checked for any visible body fluids. Blood and body fluids should never be allowed to accumulate on the cot.
- If the cot has mud on the frame or wheels it needs to be cleaned ASAP. We do not want to bring a dirty cot into our customers houses.
- Keep the moving parts on the cot lightly lubricated for efficient operation.
- **All operators are required to know how to operate all controls on the cot. If you do not know seek the proper training through your Company Officer or Paramedic in charge of the unit.**
- Operators are often tasked with moving the patient, this requires the operator to coordinate the move from the patients location to the cot, to the medic unit. The following procedures should be followed.

    1. Always cover the patient with the blankets and sheets. If it is cold weather, the head should be wrapped with a towel to protect the patient. This is especially necessary for elderly patients.

    2. If it is snowing or raining, protect the patient with a yellow emergency blanket. Remember if it is raining or snowing the patients face will need to be protected. Also if it is raining or snowing, to keep the cot dry until the patient is loaded, you can wrap the cot in a yellow emergency blanket. These procedures may require a little more effort on our part, but it provides a high level of service and consideration to our patients.

    3. When ever the cot is to travel over uneven ground or grass the cot should be four pointed for the patients safety. Thought should be given to leave the cot down for travel over rough ground. If the ground is so rough and the cot needs to be carried be sure that a minimum of four people perform this task. **It is extremely important that we never drop a patient because a cot tipped over from not being properly four pointed.**

4. When moving the patient on the cot up and down stairs leave the cot in lowered position. If you leave the cot raised it will be more difficult to clear the stairs with the wheels and may cause a hazard on the stairs for both the crew and patient.

5. When moving a patient on a cot, the patient should always be facing forward, so they can see where they are going. The only exception would be when the patient is in the semi-fowlers position and going down stairs. Then the patient should face up the stairs to minimize the feeling of falling out of the cot.

- The normal cot make up for linen is one blanket, one top sheet, one bottom sheet, one towel and one pillow with pillow case. The linen should be changed after every transport. Dirty linen is put into the hospital dirty linen containers.

- Medic unit operators should keep several pillows in reserve under the long bench seat. Pillows make good splints for some types of fractures.

- Once the cot is loaded, be sure the cot retaining device is locked in place.

- **Never raise the cot with a patient on the cot and then drop the wheels to the ground. This gives the patient an uncomfortable jolt. The wheels should be released slowly while lifting the cot to the raised position.**

County Response

- Currently LFR responds to the county for ALS ambulance service.

- When responding to the county the operator may be required to assist the paramedic or paramedics in moving equipment to the county ambulance and stabilizing the patient. Communicate en route on what the Paramedic needs the operator to assist with.

- Some paramedics have the operator put the paramedic en route with the rural squad to the hospital via radio. Establish this with the Paramedic en route to the call.

- Operators should follow the same route as the rural squad code one back to the hospital. This way if the rural squad has any sort of problem you will be close by to assist. Remember you do not follow the rural squad closely if they are traveling code 3.

- Be sure your handheld radio is on your squad work group, so the Paramedic can contact you if necessary.

Medic Unit Management Policies

- See the Management Policy index of this handbook for the MP's that reference the Medic Units.

Chapter Seven
Brush 11

This section covers Brush 11 which is currently located at Fire Station 11. This unit is a four-wheel drive 250 GPM mini-pumper equipped with a 12,000 pound electric winch. This unit is equipped for grass fires only. The rig is the only LFR unit that is capable of pump and roll operations. The pump is driven by a separate engine located behind the cab.

This unit is cross staffed with Station 11 personnel. In the event this unit is dispatched to an incident the on-duty Officer will assign either one certified operator only or one certified operator and one to two additional crew members for the response. The unit responds code 3 to all fires. All certified pump operators may staff this unit. The directions for operating this unit's pump are contained in this handbook.

Part-Time 4-Wheel Drive

This unit has part-time 4-wheel drive with automatic locking hubs. Do not use this

system on dry pavement as that will ruin the drive system. Only use this drive system when operating off dry pavement or in mud and snow.

Shifter positions
4L All four wheels driving. **Max. speed 45MPH**
N For use with PTO If equipped.
2H Normal two wheel drive.
4H All 4-wheel driving.

- Shift from 2H to 4H at speeds below 25MPH.
- Do not use 4-wheel drive on dry pavement.
- To Unlock the hubs shift to 2H. Then slowly reverse direction and go approximately 10ft.
- If an incomplete shift into 4-wheel drive occurs. Stop unlock the hubs and retry shifting into 4-wheel drive.

Pump controls and operation

- The ignition switch for starting the pump is located on the pump panel.
- There is a choke control. Use if necessary.
- There is no relief valve.
- The pump is rated at 300 GPM @ 50psi.
- The on board water tank carries 250 GPM.

- Hose:
  1. 50' section of 2 ½" hose located in the top pan.
  2. 10' section of 2 ½" hose located in the top pan.
  3. One 1" short booster line pre-connect located just above the pump panel.
  4. One 1" booster reel with 150' of line located in the rear compartment.
- Starting and operating pump.
  1. Activate ignition switch located on the pump panel. Use choke if necessary.
  2. Once the pump engine is running operate as normal pump.
- Access to pump and pump engine is through the right side compartment door right behind the cab. The unit will need it's primer oil tank checked, the engine oil level and the coolant level.

Equipment

- The unit has multiple brooms and shovels for grass fire fighting located in the right

center compartment.

- A small tool kit located in the left rear compartment.
- Bolt cutters

Winch operation and safety

- This unit is equipped with a Ramsey 12,000 pound electric winch. The most likely use for this piece of equipment is to get the unit unstuck.
- When ever the winch is used the following safety precautions should be used. These precautions are based on the manufacture's recommendations.

1. **Keep yourself and others a safe distance to the side of the cable when pulling under load.**
2. **Do not step over a cable, or near a cable under load.**
3. Do not use a vehicle to pull a load on the winch cable. This could result in cable breakage and /or winch damage.
4. Use a heavy rag or gloves to protect hands from burrs when handling the winch cable.
5. Winch clutch should be disengaged when winch is not in use and fully engaged when in use.
6. **Keep the duration of your pulls as short as possible. If the motor becomes uncomfortable hot to the touch, stop and let it cool for a few minutes. Do not pull more than one minute at or near the rated load. Do not maintain power to the winch if the motor stalls. Electric winches are for intermittent usage and should not be used in constant duty applications.**
7. Do not use the winch in hoisting applications due to required hoist safety factors and features.
8. Do not exceed maximum line pull ratings.
9. To respool correctly, it is necessary to keep a slight load on the cable. Do not allow the cable to slip through your hand and do not approach the winch to closely. When all the cable except a few feet is in, stop and finish spooling with the clutch disengaged. Always use the hook strap to hold hook when spooling.
10. Observe spooling of cable onto drum. Side pulls can cause cable to pileup at one end of the drum. To correct uneven stacking, spool out that section of the cable and move it to the other end of the drum and continue winching.
11. Do not engage the clutch with the motor running.

12. **Never connect the hook back to the cable. This causes cable damage. Always use a sling or chain of suitable strength.**

13. **When pulling a load, place a tarp over the cable five or six feet from the hook. It will slow the snap back in the event of a broken cable.**

- The winch controller is located in a red box located in the right center compartment.

- After every winch use, observe the cable when respooling for any broken or deformed strands. Report any damaged or broken cable to the maintenance shop.

Daily and Wednesday Checks

- For vehicle engine and cab do the normal checks that any apparatus gets.

- For the pump follow normal pump checks with the addition of checking the oil and coolant on the pump engine.

- On Wednesdays verify the winch motor works by connecting controller and operating the winch in and out a short distance.

Chapter 8
Hazmat 14 and Air 14

Introduction

Hazmat 14 and Air 14 are probably the units least understood by a majority of certified drivers on Lincoln Fire and Rescue. Normally the driver's stationed at Station 14 are the most familiar with the units, but neither of these units currently requires an official LFR certification to operate, therefore any certified apparatus operator could be assigned to operate these two rigs. This chapter will reference the basic information on the duties and operating requirements for these two apparatus so any operator assigned will have an idea of what is required when operating these units.

Staffing Station 14 Units

Currently Station 14 is the main HAZMAT station and contains three units E14, HM14 and A14. There are two FAO's assigned to the station. One FAO is assigned to A14/HM14 and the other is assigned to E14. E14 operates like any other Fire/EMS engine in the city unless a HAZMAT call arises, then the staffing situation changes. A14

can be dispatched to various types of incidents but the most common are working fire and HAZMAT alarms. HM14 will only be dispatched to HAZMAT level II and III incidents or HAZMAT special responses.

A14 and HM14

One FAO is assigned to maintain and operate two apparatus. The operator assigned to these two units spends a majority of his or her time operating the Air Unit. The A14/HM14 operator is responsible for the daily and Wednesday checks on both of these units. The operational concept is explained below.

A14 and HM14 Staffing for Response

- If HM14 and A14 are dispatched to a level II or III incident the FAO assigned to A14/HM14 will respond in A14 and the crew of E14 will respond in HM14 with the FAO assigned to E14 driving. HM14 will respond code three and A14 will respond code one unless there are two personnel on board, then a code three response can be made. HM14 and A14 always respond to level II and III incidents. **Any floating FAO should check with the Officer in charge at the beginning of the shift to be sure which apparatus they are to drive.**

- If HM14 is dispatched to a HAZMAT special response the FAO assigned to A14 and HM14 or the captain assigned to the station will clear the unit via radio and HM14 will stand by in the station and monitor the call on the working TAC. If the unit is needed at the scene the Officer in charge will decide on staffing for the call. If the unit is needed at the scene and the officer in charge sends the unit with the driver only, the unit will respond code one. A list of these special responses can be found in A14 and Hm14's zone books.

- If A14 is dispatched to a working fire or other incident it will respond code one unless two people are on board or otherwise directed by the Officer.

A14 Duties

- Fill SCBA and SCUBA air bottles during emergencies and as needed by companies for daily maintenance.

  All of the directions for operating the cascade system and compressors needed to fill SCBA and SCUBA bottles is contained in the following management policies:

  MP 504.08 DOT Requirements on SCBA Cylinders
  MP 855.08 SCBA Replenishment
  MP 852.08 Filling SCBA Bottles on A14-this policy is attached to the control panel of the cascade system also.

  Other relevant policies;
  MP 504.06 SCBA Repair
  MP 852.07 Breathing Air System

  SCUBA bottles are filled to 3000 psi.

- Pick-up, deliver and document SCBA's and face pieces in need of repair. Shop personnel are responsible for actual repair or maintenance work.
- Replace PASS device batteries.
- Maintain air monitoring equipment for Truck and Engine companies equipped with air monitoring equipment. Passport air monitor or Multi-rae monitor.
- Provide drinking water at emergency scenes.
- Maintain and operate SAR cart.
- Maintain and deliver additional Medical oxygen and O2 supplies to MCI's.
- Drain and fill one bank of the station cascade system on the first of the month. Management Policy MP 852.07 covers this procedure.

A14 Special Equipment

MSA SAR (Supplied Air Respirator) Cart 5 minute escape system

One of the special pieces of equipment that A14 carries is the SAR cart. This device supplies entry teams with breathable air via air hoses from the cart to the wearer. This allows personnel to work for extended times on air without the need to come back out of the work zone to change bottles as the air cart operator will take care of swapping bottles. Below is the basic maintenance and operating guidelines for the SAR cart.

System components

SAR 5 minute escape bottles contained in black suit cases behind the compressor on A14
4 bottles- 2 for entry team and 2 for back up team.
Each bottle is rated for 10 minutes.
Personnel use their own mask with this system.
4 back up 5 minute sets at Station 14 on apparatus floor shelves.
5 Short hoses located in bag on SAR cart for connecting to regular SCBA air packs.

SAR air cart with two 60 minute SCBA bottles.
Approximately 11-50' sections of air hose. More hose is available and stored at Station 14.

Basic operating instructions

- Put the SAR escape bottle over wearers right hip.
- Firefighter wears his/her own face piece.
- Hooks up the same as regular SCBA's.
- Air supply comes from the SAR cart.
- The SAR cart hose connects to the nipple on left hip waist strap.
- operator should use the air from the SAR cart at all times unless you have an emergency.
- Blue switch on tip is pointed to tank that you are using, when first tank is empty, turn the blue level to point at the other tank. Whenever you empty a tank, change out the tank immediately.
- Outlets in front of the right tank.

- To drain, turn tank off, bleed air, hold red button for 5 beeps.
- Instructions located in the same bag as the short hoses on the air cart.
- Maximum hose length from the cart to the wearer is 300 feet.

Wednesday check for SAR cart and bottles

- Be sure both the air cart 60 minute bottles and the 5 minute escape bottle are full.

60 Minute HAZMAT SCBA Air Packs and Bottles

Air 14 carries 60 minute bottles and SCBA harnesses. These 60 minute sets are for hazardous material team use only. They are not to be exchanged out with fire suppression companies. These harnesses and bottles are carried on the passenger side of the rig and are marked HAZMAT 60-minute.

Wednesday check

- Mechanically do all the same checks as other response apparatus.
- Make sure the cascade system is full.
- Make sure all harnesses are accounted for and the bottles are full.

Monitoring Equipment

- Two spare Passport, four gas monitor for the truck companies.
- One multirae, four gas monitor calibration kit.
- One spare Drager Micro Pac.

Monitor Daily and Wednesday Check

- Passports will require calibration once a month and a bump test covered in MP 504.12 the rest of the month.
- There are no daily checks other than confirm the equipment is not missing from the unit.
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MCI Medical Oxygen Supply

- One cylinder equipped with Multi Tap O2 manifold and oxygen masks.
- Monitor the bottle pressure to maintain a full bottle.

A14 Vehicle Operational Guidelines

- When operating at an incident be sure the fast idle engages.
- When operating at an incident in hot weather the AC should be shut off and the hood opened to help keep the unit from over heating.
- The vehicle has a high center of gravity, so be aware of roll over when operating on uneven terrain.

Hazmat 14 operator duties

- Perform Wednesday and daily checks.
- Maintain all equipment carried on the unit. Including all monitors, computers, cell phones, PPE, etc.
- Perform HAZMAT inspections. (acting FAO's will not perform this duty)
- At HAZMAT emergencies the FAO will be responsible for setting up the apparatus including retrieving equipment for personnel, awning deployment, weather pack set-up and assist HAZMAT command with documentation and product research.

HAZMAT 14 Special Equipment

On this unit, the whole equipment complement is really special equipment. This document will list some of the equipment on the unit and identify the equipment that needs daily or monthly attention, but the equipment complement could change from time to time and any operator will may have to utilize regular Station 14 personnel to keep up to date.

- HM14 is equipped with a WeatherPak 400 monitoring system. This device determines wind speed, direction, and stability class of the wind. It also determines temperature. The unit takes samples every two seconds and then computes the information into a 5-minute running ave. Data is then transmitted back every 30 seconds. It also has an electronic compass that determines North automatically.
- The WeatherPAK 400 collection device is located in a compartment on the roof of the vehicle and the mounting position is located on the roof of the cab. The data read out is located in the command center portion of the cab. To assemble the system follow the steps below. These are general instructions and still require personnel to train and familiarize themselves on the actual equipment.

    1. Remove the cap on the mounting bracket located on the rear portion of the roof of the cab behind the protective shield.
    2. Insert the large cylinder into the mounting bracket. Note that only one end fits into the bracket and must be inserted with the correct orientation for the electrical contacts to align properly.
    3. Attach the propeller to the weather vane portion of the device. Use the nut located on the shaft to hold the propeller on. Tighten this nut only hand tight, no wrench is necessary.
    4. Insert the weather vane shaft into the top on the large cylinder installed earlier. Again, be sure it is properly aligned before inserting. This completes the set-up.
    5. Now proceed to the command area of the rig and turn on the power strip and the weather pack readout box (blue). Within a few minutes weather data will appear on the screen.

6. Also be sure the patch cable from the blue box is attached to the lap top computer.

- HM14 is equipped with an awning located on the officer side of the rig. It requires three personnel to deploy. This awning should be deployed at any incident where relief from the Sun or rain is desired. Do not deploy in high wind conditions. Follow the steps below to deploy:

    1. You will need at least two personnel to deploy the awning, but three is best. One each located on the front and back arms of the awning. The Third person will retrieve the steel bar with a hook approximately 3 foot long that is located in the first compartment on the passenger side just past the side door on the shelf.

    2. The two personnel on the arms will unlock the awning supports that are located approximately half way up the arm and loosen the knob on the back of the arm. The person with the hook will use it to first to unlock the awning. The lock is located on the right side up high by the rolled up awning. You pull the lever down to unlock and push it up to lock. Unlocking may take several attempts. Once the awning is unlocked the same person will use the hook to pull the awning out. The hook slides into the black webbing eyelet attached to the top center of the rolled up awning.

    3. To deploy the awning pull out and down. Once the awning is fully unrolled to the first stage the two personnel on the front and back arms will push out and lock the two smaller arms that are now exposed.

    4. Then the two personnel located on the front and back arms will push out the arm extensions until they are locked in at the desired awning height.

    5. If needed the two arms may be detached from the rig and spiked to the ground to provide a flat roof overhead.

    6. Reverse this procedure to retract the awning.

- HM14 is equipped with a generator. This generator should be started during any long duration incident. The steps for activating the generator are located in the first compartment on the driver's side of the vehicle.

- Monitoring equipment and cameras:

    1. (2) APD 2000
    2. Drager Emergency Response kit
    3. Guardian Bio Threat Alert
    4. (4) Multrae four gas monitors
    5. MSA Quick draw tubes
    6. Evidence Sampling kit
    7. Passport monitor?
    8. Passport and Multrae Calibration kits

9. Gas Sentry Combustible Gas Analyzer
10. Digital Camera
11. Digital Video Camera
12. (2) lap top computers

- Level A full encapsulating suits
- Level B full encapsulating suits
- Level B non full encapsulating suits
- Decontamination equipment and portable water heater
- Chlorine leak kits
- Non-sparking tools
- Plugging and patching supplies
- Various resource books
- (2) Ludlum 2241-2 Radiation Monitors
- (2) Radiological Emergency Response kits
- (2) Dosimeter Personal units and Handheld unit.
- (2) Civil Defense Dosimeters (yellow units)
- (1) Purple k fire extinguisher
- (1) Dry Chemical extinguisher

HAZMAT 14 Wednesday and Daily Checks:

- Mechanically follow all the same guidelines as engines and trucks.

- Start the Generator during Wednesday check and assure that all scene lighting and outlets are working properly.

- **Note: Before tilting the cab on this unit there are two diaphragm locks located between the cab and the box on the inside that have to be released. If this is not done damage may occur to the unit.**

- The passport, multirae and the combustible gas monitor will need tests done. **Station 14 personnel will assist a floating driver with this if necessary**.

Apparatus Operator Handbook
Management Policy Reference List

General Policies

101.03 12/98	Lincoln Fie and Rescue Response Time Goal
104.03 05/01	Peer Review Committee
202.50 11/00	Position Description FAO FAO Haz-Mat 14
202.15 12/03/04	FAO Skills
202.19 09/04	FAO Certification/Re-certification Process
202.21 11/04	Promotional Process to Fire Apparatus Operator
208.07 09/93	Operators License

307.01 07/94 Apparatus Overhead Doors
501.05 05/02 Oxygen Cascade System Operation Procedure
502.10 07/22/96 Overhead Doors in Apparatus Areas
502.13 12/99 Fire Station Apparatus Doors
503.00 07/03 Vehicle Station Assignments
503.01 12/03/04 Apparatus & Equipment Maintenance Request
503.02 12/03/04 Apparatus & Equipment Inspection Policy
503.04 05/98 Use of Relief Valves
503.05 09/93 Washing Apparatus
503.08 03/01 Reserve Apparatus Care and Maintenance
503.09 12/00 Apparatus and Vehicle Fueling Requirement
503.10 06/96 Vehicles Alteration Policy
503.11 02/99 Fire Apparatus Parking
503.12 01/03 Oil Changes
508.13 04/02 Fire Station Library Books for Promotion to FAO

804.01 12/98 Apparatus Status
808.04 02/01 Fire Response State Penitentiary
808.05 01/01 Medical Response State Penitentiary
808.12 12/00 Correctional Facility Emergency Response
850.02 12/99 Vehicle Accident Reporting Process
850.03 01/98 Zone Coverages for First Alarms
850.05 12/17/04 Trench Rescue
850.06 11/04 Structural Collapse
852.03 07/01 Wet Water
852.12 04/01 Apparatus Response
852.18 09/93 Transfer Valve
852.23 10/98 Use of Supplementary Braking System
855.03 01/01 Apparatus Backing Procedure
855.04 02/93 Safety and Use of Seatbelts
855.05 01/03 Evacuation Warning Procedure
855.15 01/28/05 Foam Application
859.60 05/04/95 Apparatus Driving

905.01 02/04 FAO Certification/Re-certification Study Information
MDT Power point document located on the LFR Secure web site.

Apparatus Equipment Related Policies

502.14 07/04 Glucometer Maintenance and Upkeep
503.06 09/93 Fire Extinguisher Maintenance
504.01 09/05/03 Hose Testing Procedures
504.02 12/93 Hose Care and Handling
504.13 01/01 Use and Care of Life Pak 12 Defibrillator/Monitor
504.14 03/04 Battery Maintenance for Defibrillator carried by LFR Apparatus
504.15 04/01 Engine Inventory List
507.01 08/02 Hose Records/Inventory
852.09 09/98 Maximum Fire Hose Pump Pressure

Truck Company Equipment Policies

504.03 09/93 Rescue Rope Care
504.04 12/98 Rescue Rope Replacement

504.12 10/96 Maintenance of Passport Detector
852.17 09/93 Aerial Set up and Stabilization

Supplements to the Essentials Manual on the Lincoln Fire and Rescue non-secure part of the web site under Training Division. The site contains care and maintenance information for various saws and equipment carried on LFR Truck Companies.

Medic Unit Related Policies

501.09 05/02 On board Oxygen Systems
803.00 12/01/04 Patient Transfer Forms
808.51 01/01 LFR Mutual Aid-ALS with Rural Departments
821.01 12/00 Transfer Medics
821.02 10/02 Ambulance Rig Change Outs
821.03 12/01 Ambulance Operator
822.02 12/01 Medic Unit Duties at Working Incidents-Rescue
822.06 12/00 Medic Unit Seatbelt Use

AIR 14 Related Policies

504.06 06/01 SCBA Repair
504.08 01/00 DOT Requirements on SCBA Cylinders
852.07 09/04 Breathing Air System
852.08 04/98 Filling SCBA Bottles on A14
855.08 06/01 SCBA Replenishment

Speciality Units and Equipment Polices

859.31 08/04 Mass Decontamination Trailer
859.61 12/03 Trailer Towing
859.62 03/04 Light Tower CMP
852.21 05/04 Decon 1 Operation
870.00 03/00 Haz-Mat 14 Modes of Response